NEW AUSTRALIAN LORICATA AND NOTES ON THE DISTRIBUTION OF CERTAIN SPECIES. 1.

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II.

Ischnochiton verconis.

Ischnochiton verconis Torr, Trans. Roy. Soc. S. Aust., 1911, xxxv., p. 102.
Ischnochiton verconis Ashby, Proc. Roy. Soc. W. Aust., 1921-2, viii., p. 33.

Dr. Torr's type of *Ischnochiton verconis* remained as the only published record until Ashby recorded a specimen in the Western Australian Museum taken at Bernier Island.

While on the voyage from Albany to Esperance in November, 1921, the s.s. *Eucla* called at Hopetoun, where I seized the opportunity afforded by an hour's loading, of examining the rocks near the jetty. Here I had the good fortune to take two fine examples of *I. verconis*, on opposite sides of the same stone, in about 2 feet of water at low tide. At first glance I took them to be *Ischnoradsia australis*, the dark slate colour, large size, and active movement away from the exposed surface of the stone all suggesting that species. Closer examination, however, soon convinced me that I had secured Dr. Torr's species at a distance of about 300 miles from the type locality and subsequent comparison with the type confirmed my identification. The Bernier Island record extends the range of this rare species over nearly 1,000 miles of the south and south-western coast of Western Australia.

Dr. Torr did not disarticulate his type, and therefore was unable to examine the slitting, but considered that there were eight teeth in the anterior valve. I have disarticulated one of my shells, and find that the formula is 12-1-12. In its girdle characters, sculpture, and general appearance this shell differs from all other *Ischnochitonidae*, and I therefore propose a new genus for it, placing it between Heterozona and Anisoradsia.

Strigichiton, *new genus*.

Shell broad, tegmentum very strongly reticulated and elaborately sculptured.

Girdle covering, scales of varying sizes, very deeply grooved or channelled. Anterior and posterior valves having 12 slits, median valve 1 slit. All teeth very sharply cut, not pectinated.

Type. *Ischnochiton verconis* Torr.

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1. In the first part of this paper (p. 157 ante) I used the ordinal name Polyplacophora (Gray, 1824). As shown in this journal (p. 186) Schumacher's Loricata has priority over Gray's name. The following corrections should be made in Part I: on page 158. For "Mrs. Arthur North," read "Mrs. D. S. North," and on page 164 for "Rhyssoplax carnosus" read "Rhyssoplax carnosa."

Ischnoradsia australis divaricata n. subsp.

Plate xxvii. Figs. 1, 1a, 1b, and 1c.

At Caloundra and Point Cartwright, South Queensland, I took numerous examples of an *Ischnoradsia* which, although belonging to the eastern Australian species *australis*, showed sufficient variation in sculpture to warrant its separation as a subspecies. The central areas are strongly sculptured with two or three rows of straight vertical lines, separated by fine horizontal lines after the pattern of a picket fence. The sculpture of the lateral areas is much more branching and composed of fewer riblets than in *I. australis*. Examination of a series of juvenile specimens shows that this sculpture commences in the form of three small rounded tubercles near the exterior margin (fig. 1a). These tubercles are increased by one or more behind the first, which show a tendency to become elongated (fig. 1b). The exterior margin then shows three tubercles, with a succession behind of three or more rows (fig. 1c). The tubercles are then rapidly elongated, gradually extending to and partially fusing with each other, thus forming the widely branching sculpture of the adult shell (fig. 1).

Acanthochiton purpuratus, n.sp.

Plate xxvii., Fig. 2.

Shell large, elevated, carinated, side slopes convex. Colour, ochraceous, flecked with dull red.

Anterior valve densely covered with small oval pustules tending to radiate towards margins; no definite raised ribs.

Median valves; lateral areas not differentiated, having several rows of small rounded or oval pustules arranged more or less vertically; dorsal area very large, V-shaped, vertically striate with faint cross lines, forming at the apex a very strong beak.

Posterior valve with prominent mucro behind the middle, straight behind, covered with pustules except on the dorsal.

Girdle as wide as the exposed portion of the valves, colour dull purple, densely clothed with calcareous spicules and having large spiculose tufts opposite the sutures, which are generally withdrawn and disappear as the girdle dries.

Interior white; anterior valve 5 slits, median valves, 1 slit, the posterior valve in the specimen disarticulated is irregularly slit, there being ten teeth, some doubtless the result of interslitting.

Dimensions: 18 x 11 mm. (dry).

Station: Under stones in rock pools at low tide.

Locality: Betangabe Inlet near Twofold Bay; (type), Port Jackson, Long Reef and Shellharbour, N.S.W.

Remarks: Differs from *A. wilsoni* Sykes in the size, shape and arrangement of the pustules which are oval instead of triangular, and the much larger dorsal area.

When collecting with me on Long Reef, north of Manly, New South Wales, in 1908, my brother W. D. Hull, found two specimens of an *Acanthochiton* having a very wide and spongy girdle which he at first mistook for *Cryptoplax*. Hedley and I (Rec. Aust. Mus., 1909) recorded this discovery as *Acanthochites wilsoni* Sykes, but subsequent examination of typical examples of this shell from Port Phillip led me to doubt the accuracy of our identification. I then sent the two shells to Iredale, who considered that they represented a new species. Roy Bell subsequently collected two similar shells at Betangabe Inlet, south of Eden, New South Wales. In 1922 G. McAndrew took two smaller shells of the

same species near Point Bass, Shellharbour, New South Wales, and during the present year (1923) two specimens have been discovered at the famous collecting ground, Bottle and Glass, Vaucluse, Port Jackson, one by W. Barnes and the other by A. E. J. Thackway.

Lorica paucipustulosa, n.sp.

Plate xxvii. Fig. 3.

Shell large, elevated, carinated, side slopes convex. Colour, deep reddish-brown.

Differs from *L. volvox* Reeve and *L. cimolia* Reeve in the small number and scattered nature of the pustules on all valves, and in the ribs of the central areas, which are only three extending across the area with one or two short ribs near the dorsal area.

Girdle covered with large and small polished scales, and with scattered spiculose tufts not related to the sutures.

Interior white. Anterior valve with 10 slits, median valves with 1 slit. All teeth, and posterior valve callus, pectinated.

Dimensions: 50 x 28 mm.

Station: Under stones at low tide.

Locality: Rabbit Island, King George Sound, Western Australia.

Remarks: This shell is striking in the simplicity of its sculpture, contrasting strongly in this respect with the South Australian and New South Wales species. Specimens larger than the type were collected, but they were much eroded. Traces of a secondary sculpture could be seen, the central areas becoming more wrinkled towards the margin. These examples measured up to 70 x 35 mm.

Genus Liolophura.

Pilsbry (The Nautilus, 1893, vi., p. 105) established the genus *Liolophura*, taking *Chiton japonicus* Lischke as the type, with the following definition:— "Valves exposed, dull and somewhat roughened, generally eroded outside, with minute eyes irregularly scattered over the lateral areas, the head-valve and the sides of the central areas. Interior dark coloured, having anterior and side insertion-plates slit into teeth and sharply pectinated outside; posterior valve with posterior terminal mucro, lacking the insertion-plate, which is represented by a flat callous ledge. Sinus wide, deep, smooth. Girdle covered with stout calcareous spines or obtuse club-shaped processes."

He listed *L. gaimardi* Blainville and *L. georgiana* Quoy & Gaimard as the Australian representatives of the genus, but provisionally noted *Chiton curtisianus* Smith, which he was disposed to believe was a member of the genus. This shell, however, is now definitely placed in the genus Squamopleura, the posterior valve having teeth.

Pilsbry noted that the valves of *L. gaimardi* are "always considerably eroded," but he observed that they were "concentrically wrinkled toward their bases." The girdle he described as "densely clothed with intermingled, minute, larger and large calcareous spines." Quoy and Gaimard described the valves of *L. georgiana* as "having concentric striae, the anterior and lateral most marked." The girdle was "very thick, little dilated at the sides, covered with very small rounded tubercles."

Blainville, however, published (1826) *Chiton hirtosus* Péron, from "Seas of the Island of King," which he compared with the preceding species (*L. gaimardi*) as being "less long and broader," and with a girdle "covered with a multitude of little squamo-spinous tubercles." In publishing this (translated) description Pilsbry, in his Appendix of "Insufficiently described Chitons, and species of un-

known generic position" (Man. Conch, 1892, xiv., p. 106) says "This may be an *Onithochiton* or a *Liolophura*." W. L. May and I both collected at many stations on King Island in 1922, including the locality visited by Péron and Lesueur in 1802, but we failed to discover any trace of a *Liolophura* or any shell that could be made to fit the description of *C. hirtosus*. Péron, however, also collected at King George Sound, Western Australia, in 1802 (the type locality of Quoy and Gaimard's *L. georgiana*) and his collection passed through many vicissitudes before it was ultimately examined by Blainville. A confusion of locality probably occurred, such as undoubtedly took place in the case of *Chiton* (*Stenochiton*) *longicymba* Blainville, which was attributed to "Seas of the Island of King" (where I failed to find it) whereas it is very plentiful in the harbour at Albany, King George Sound. I collected large numbers at the Quarantine Ground, Albany.

In 1894 Pilsbry published (Proc. Acad. Nat. Sci. Philad., p. 87) a revised synonymy of *L. gaimardi* Blainville, and described a shell from Bundaberg, Queensland, as variety *L. Gaimardi queenslandica*, distinguishing it by the larger size, the more slender girdle spines, and the uniform black colour of the girdle.

I have collected a very large series of each of the three foregoing species, my field extending over 300 miles of South Western Australia (King George Sound to the Recherche Archipelago), the whole New South Wales coast; and the coast of Queensland from Southport to Townsville. My collections include perfect examples of the Western Australian and Queensland species, so that I am enabled to present figures approaching that degree of perfection that is the goal of all students of this fascinating group of mollusks, together with fairly good examples of the New South Wales shell. The result of my work, I think, justifies the following revision of the genus.

Liolophura gaimardi.

Plate xxviii. Figs. 1-4.

Chiton gaimardi Blainville, Dict. Sci. Nat., 1825, xxxvi., p. 546.
Chiton incanus Gould, Proc. Bost. Soc. Nat. Hist., 1846, ii., p. 145.
Maugeria incanus Gould, Otia, p. 248.
Acanthopleura incana E. A. Smith, 1884, Zool. Coll. H.M.S. Alert, p. 81.
Liolophura gaimardi Pilsbry, Man. Conch., 1893, xiv., p. 240.
Liolophura gaimardi Hedley, Proc. Roy. Soc. N.S.W., 1918, li., (supp.).

Shell the smallest of the genus. Lateral areas not very clearly differentiated; sculpture of all valves consisting of concentric lines; in very young examples the areas between the lines are slightly pustulose. Girdle scales of three distinct forms: (a) small, pebbly, rounded, irregular scales, (b) larger conical truncated spines, (c) long, pointed, slightly curved spines.

Interior: Dull purple, sutural laminae white.

Dimensions: 45 x 25 mm.

Station: On the upper surface of rocks, in crevices, and on the dead shells of rock oysters, between high water and median tide mark.

Locality: New South Wales, from Port Hacking to Broken Bay (about 40 miles of coast line from point to point, not including indentations of the four harbours opening on to the coast).

Remarks: Very common in Port Jackson and Broken Bay, but rare on the ocean front. Valves nearly always eroded, even in very young examples. Although I have failed to discover this species outside of the very limited range above indicated, it is quite possible that it may yet be found to extend further along the New South Wales coast.

Liolophura queenslandica.

Plate xxviii. Figs. 5-8.

Liolophura gaimardi queenslandica Pilsbry, Proc. Acad. Nat. Sci. Philad., 1894, p. 87.

Liolophura gaimardi, var. *queenslandica* Hedley, A.A.A.S., 1909, p. 352.

Liolophura gaimardi Iredale, Proc. Mal. Soc., 1910, ix., p. 157.

Shell larger than the preceding; anterior valve covered with oval tubercles not arranged in any distinctly radial lines. Lateral areas of median valves clearly differentiated, sculptured with seven or more radiating rows of oval tubercles; central areas horizontally lined. Posterior valve with mucro nearly terminal; ante-mucronal area horizontally lined, post-mucronal area tuberculate. Girdle scales somewhat similar to those of *L. gaimardi*, but smaller, the conical type predominating.

Interior: Dark purple-brown, sutural laminae lighter, but not white.

Dimensions: 55 x 35 mm.

Locality: Queensland, from Caloundra (Bribie Island) to Townsville, about 800 miles of coast line.

Station: Similar to that of *L. gaimardi*, and under stones in rock pools.

Remarks: Very common on the ocean coast, even in the most exposed positions, where the valves are greatly eroded; when found under stones in rock pools the sculpture is less affected, examples being occasionally found with the sculpture intact. In this station the girdle is distended to such an extent that the scales and spines are widely separated, showing the white surface of the integument to which they are attached. Upon removing the shell from the stones, however, the girdle rapidly contracts, and the covering scales and spines become crowded together, as seen in all dried specimens. I here suggest that in this and other genera having wide fleshy or spongy girdles (e.g., *Plaxiphora* and *Onithochiton*) and which occupy similar stations, uncovered by water for a great part of the day, the girdle is utilised as a reservoir, sufficient water being absorbed during high tides to keep the gills supplied when the tide has receded, leaving the shells exposed to the air.

Clavarizona, *new genus.*

Similar to *Liolophura*, excepting the girdle covering, which consists of short, obtuse, striated scales, resembling the heads of aboriginal clubs or nulla nullas. Type, *Chiton hirtosus* Blainville.

Clavarizona hirtosa.

Plate xxviii. Figs. 9-12.

Chiton hirtosus Blainville, Dict. Sci. Nat., 1826, xxxvi., p. 546.

Chiton georgianus Quoy & Gaimard, Voy. de l'Astrolabe, Zool., iii., p. 379, t. 75, f. 25-30.

Liolophura georgiana Pilsbry, Man. Conch., 1892, xiv., p. 241.

Chiton georgianus Iredale, Proc. Mal. Soc., 1910, ix., p. 154 and 1916, xii., p. 105.

Acanthopleura (*Liolophura*) *georgiana* Thiele, Fauna Sud-West. Aust., 1911, p. 399.

Liolophura georgianus } Torr, Trans. Roy. Soc. S. Aust., 1911, xxxv.,
Plaxiphora pustulosa. } p. 100 and 107.

Acanthopleura (*Liolophura*) *hirtosa* Dupuis, Bull. Mus. d'Hist. Nat., 1917, xxiii., p. 533.

Liolophura georgiana Ashby, Trans. Roy. Soc. S. Aust., 1921, xlv., p. 45, Proc. Roy. Soc. W. Aust., 1921-2, viii., p. 32.

Liolophura (*Chiton*) *hirtosus* Ashby, Trans. Roy. Soc. S. Aust., 1922, xlvi., p. 579.

Chiton hirtosus Lamy, Bull. Mus. d'Hist. Nat., 1923, p. 263.

Shell large, broadly oval, moderately carinated, side slopes convex. Colour, olive-green, brown, or black, the two former generally having the dorsal area darker in a series of V-shaped markings, the black shells occasionally exhibiting on one or more of the median valves white patches which extend to the adjacent part of the girdle.

Anterior valve crowded with oval tubercles, irregularly radiating towards the margin; several concentric growth lines causing undulation of the surface.

Median valves with lateral areas strongly differentiated, sculptured with eight or more radiating rows of elongated polished tubercles; central areas with numerous wavy concentric lines over the dorsal area, and breaking up into large oblong tubercles becoming more pronounced towards the margins. Valve ii. also shows three or more vertical lines on the dorsal area, crossing the wavy lines and converging posteriorly.

Posterior valve with projecting terminal mucro, the large ante-mucronal area sculptured similarly to the central areas of the median valves; the post-mucronal area almost recurved, and sculptured with a few elongate tubercles.

All valves with numerous ocelli, scattered on valve i., and chiefly along the diagonal in two or more rows on valves ii. to viii.

Girdle densely clothed with short, obtuse or conical striated scales; colour generally in bands of white and black alternating, the portions in front of the anterior and behind the posterior valves being white.

Interior purple-brown, sutural laminae whitish. Anterior valve with 10 slits, median valves 1 slit, all insertion plates deeply pectinated; posterior valve with broad, rough callus.

Dimensions: The largest example collected by myself measures, dry, 60 x 35 mm.

Station: On the outside, or in crevices of the rocks between high spring and mean tide marks. Juveniles are sometimes found under stones or occupying the interstices between the convolutions of *Galeolaria caespitosa*.

Locality: South Western and Western Australia, extending from Eyre Patch (Great Australian Bight) near the South Australian border to Point Cloates, North Western Australia. Further search may extend the range, both east and north.

Remarks: This is the commonest shell of the Western Australian littoral, being found both on the exposed ocean coasts and along the shores of the most sheltered inlets. The valves are generally eroded or covered with algal or calcareous growths. Specimens showing the sculpture intact are rare, but well worth seeking for.

Reference to the authorities quoted above will show that this shell has enjoyed a good deal of discussion, both as to its generic position and nomenclature. Undoubtedly Péron was the first to collect it, and Blainville the first to publish Péron's manuscript name, with a concise description that is not applicable to any shell which could have been taken at "L'Ile King," the locality assigned to it by the collector. The fact, referred to by Thiele, Dupuis, Ashby and Lamy in their various contributions, that the collection of the Paris Museum contains three specimens assigned to this species, one of which is an *Acanthopleura*, perhaps accounts for the name *hirtosus* (*hirtus* = prickly), the name being more appropriate to the spiny girdle of the northern species. Although Thiele was the first to suggest the identity of Quoy and Gaimard's *C. georgianus* with Blainville's *C. hirtosus* he did not use the latter name. Dupuis was the first to adopt Thiele's suggestion.

The figures shown on Plate xxviii. are particularly interesting when comparison is made between the sculpture of *L. queenslandica* and *C. hirtosa*, which are almost identical in that respect, while the girdle scales are so markedly different. Further, the scales of *L. gaimardi* and *L. queenslandica* are very similar, while the sculpture is entirely different.

These three shells appear to be degenerate Acanthopleurids, having lost the teeth of the posterior valve. In pushing out from their tropical centre of origin they have proceeded southwards by two distinct routes of migration, west and east; in the former case pushing round the Leeuwin and along the shores of the Great Australian Bight, meeting with no serious bar in the shape of cold waters. This branch, while degenerating internally like the eastern branch, also went through a modification of the girdle covering quite distinct from the other migrants. The eastern species suggest two separate waves of migration, the first extending down the coast of New South Wales, developing an altered form of sculpture, and degenerating in the posterior valve. This primary wave seems to have been cut off, its remnants being confined to a comparatively limited portion of the New South Wales coast line and it never rounded the south of Tasmania, even if it reached so far prior to the separation of Tasmania from the mainland. It was followed by another wave, which has retained much of the sculpture and the dark internal colouration of its ancestors, while again degenerating in the loss of teeth in the posterior valve, and the modification of the girdle covering. This wave has reached only to the northern shores of Moreton Bay.

EXPLANATION OF PLATES.

Plate xxvii. Fig. 1. *Ischnoradsia australis divaricata*, n.subsp.
„ 1. (a, b. and c.) „ „ juvenile.
„ 2. *Acanthochiton purpuratus*, n.sp.
„ 3. *Lorica paucipustulosa*, n.sp.

Plate xxviii. Figures show anterior and posterior valves, one-half of a median valve, and a section of the girdle of:—

Figs. 1-4. *Liolophura gaimardi* Blainville.
„ 5-8. *Liolophura queenslandica* Pilsbry.
„ 9-12. *Clavarizona hirtosa* Blainville.